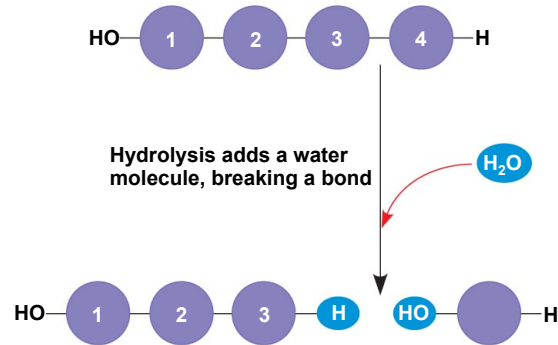


(a) Dehydration reaction in the synthesis of a polymer



(b) Hydrolysis of a polymer

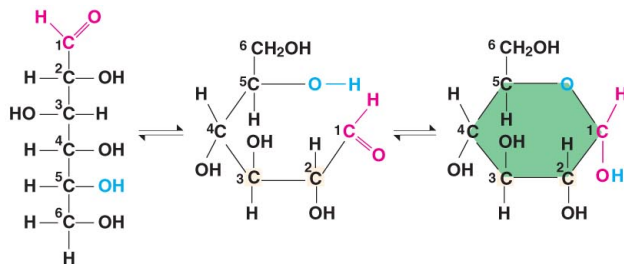
Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.

1

	Trioses (C <sub>3</sub> H <sub>6</sub> O <sub>3</sub> )	Pentoses (C <sub>5</sub> H <sub>10</sub> O <sub>5</sub> )	Hexoses (C <sub>6</sub> H <sub>12</sub> O <sub>6</sub> )	
Aldoses	$  \begin{array}{c}  \text{H} \\    \\  \text{C}=\text{O} \\    \\  \text{H}-\text{C}-\text{OH} \\    \\  \text{H}-\text{C}-\text{OH} \\    \\  \text{H}  \end{array}  $ <p>Glyceraldehyde</p>	$  \begin{array}{c}  \text{H} \\    \\  \text{C}=\text{O} \\    \\  \text{H}-\text{C}-\text{OH} \\    \\  \text{H}-\text{C}-\text{OH} \\    \\  \text{H}-\text{C}-\text{OH} \\    \\  \text{H}  \end{array}  $ <p>Ribose</p>	$  \begin{array}{c}  \text{H} \\    \\  \text{C}=\text{O} \\    \\  \text{H}-\text{C}-\text{OH} \\    \\  \text{HO}-\text{C}-\text{H} \\    \\  \text{H}-\text{C}-\text{OH} \\    \\  \text{H}-\text{C}-\text{OH} \\    \\  \text{H}  \end{array}  $ <p>Glucose</p>	$  \begin{array}{c}  \text{H} \\    \\  \text{C}=\text{O} \\    \\  \text{H}-\text{C}-\text{OH} \\    \\  \text{HO}-\text{C}-\text{H} \\    \\  \text{H}-\text{C}-\text{OH} \\    \\  \text{H}-\text{C}-\text{OH} \\    \\  \text{H}  \end{array}  $ <p>Galactose</p>
	$  \begin{array}{c}  \text{H} \\    \\  \text{H}-\text{C}-\text{OH} \\    \\  \text{C}=\text{O} \\    \\  \text{H}-\text{C}-\text{OH} \\    \\  \text{H}  \end{array}  $ <p>Dihydroxyacetone</p>	$  \begin{array}{c}  \text{H} \\    \\  \text{H}-\text{C}-\text{OH} \\    \\  \text{C}=\text{O} \\    \\  \text{H}-\text{C}-\text{OH} \\    \\  \text{H}-\text{C}-\text{OH} \\    \\  \text{H}  \end{array}  $ <p>Ribulose</p>	$  \begin{array}{c}  \text{H} \\    \\  \text{H}-\text{C}-\text{OH} \\    \\  \text{C}=\text{O} \\    \\  \text{HO}-\text{C}-\text{H} \\    \\  \text{H}-\text{C}-\text{OH} \\    \\  \text{H}-\text{C}-\text{OH} \\    \\  \text{H}-\text{C}-\text{OH} \\    \\  \text{H}  \end{array}  $ <p>Fructose</p>	

Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.

2

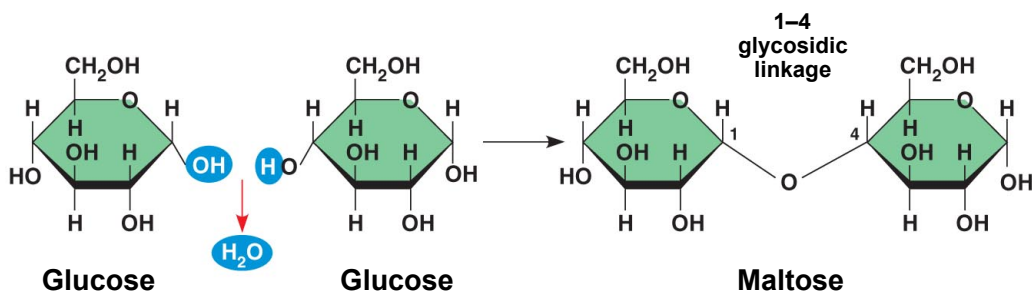


**(a) Linear and ring forms**

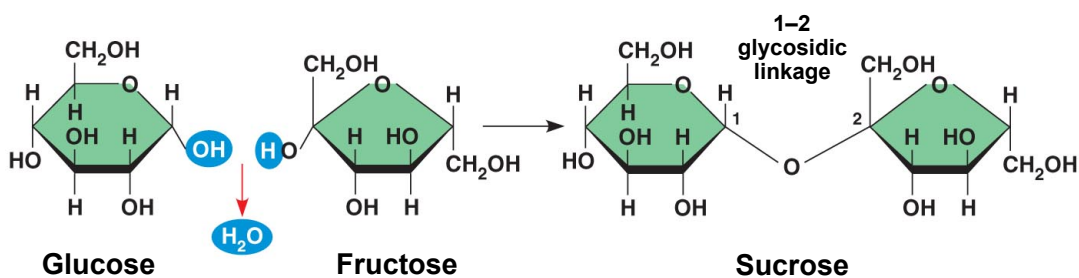
Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.

**(b) Abbreviated ring structure**

3



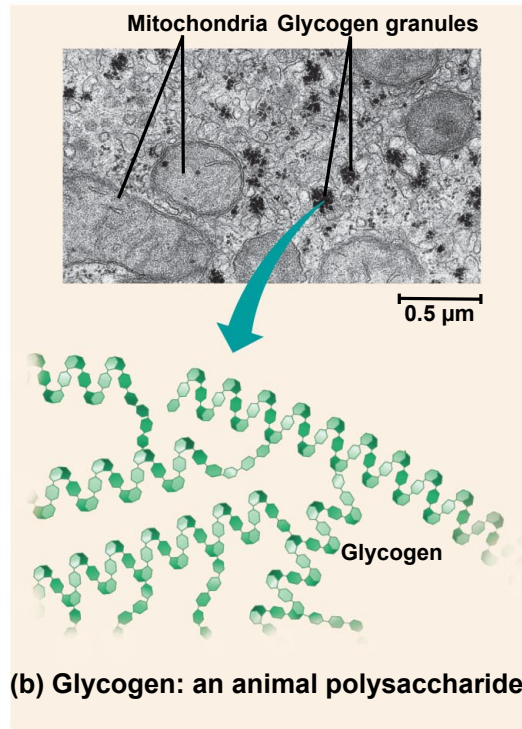
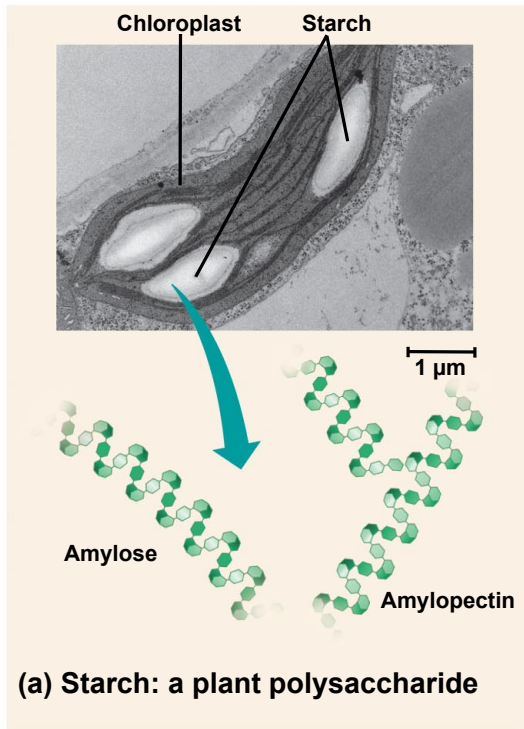
**(a) Dehydration reaction in the synthesis of maltose**



**(b) Dehydration reaction in the synthesis of sucrose**

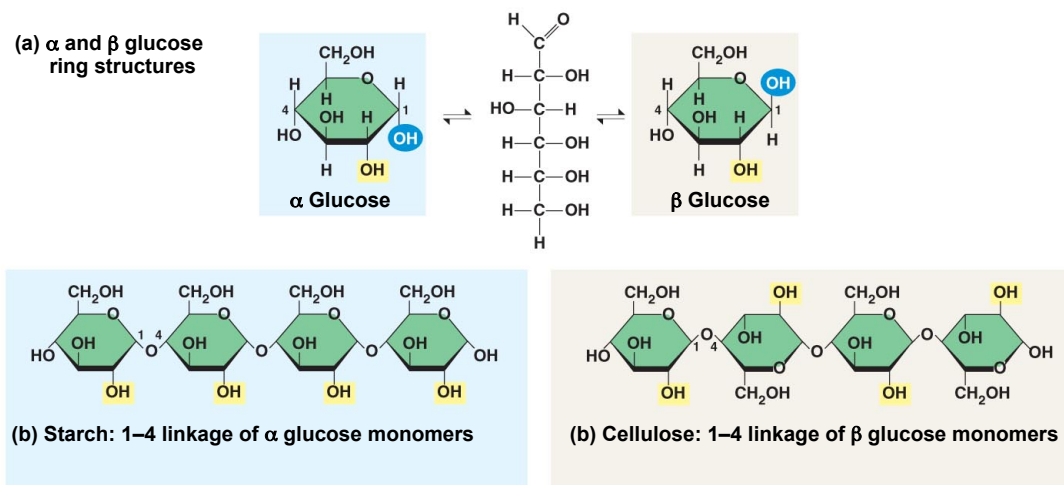
Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.

4



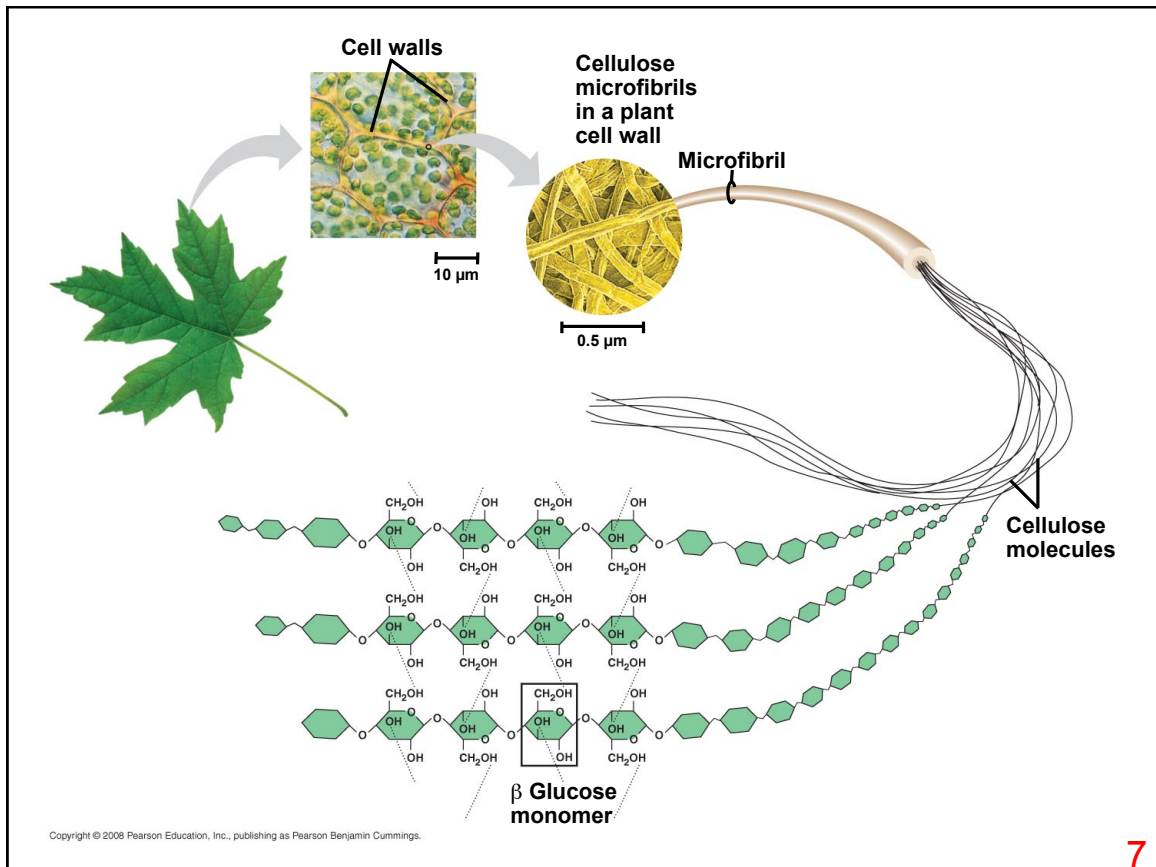
Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.

5

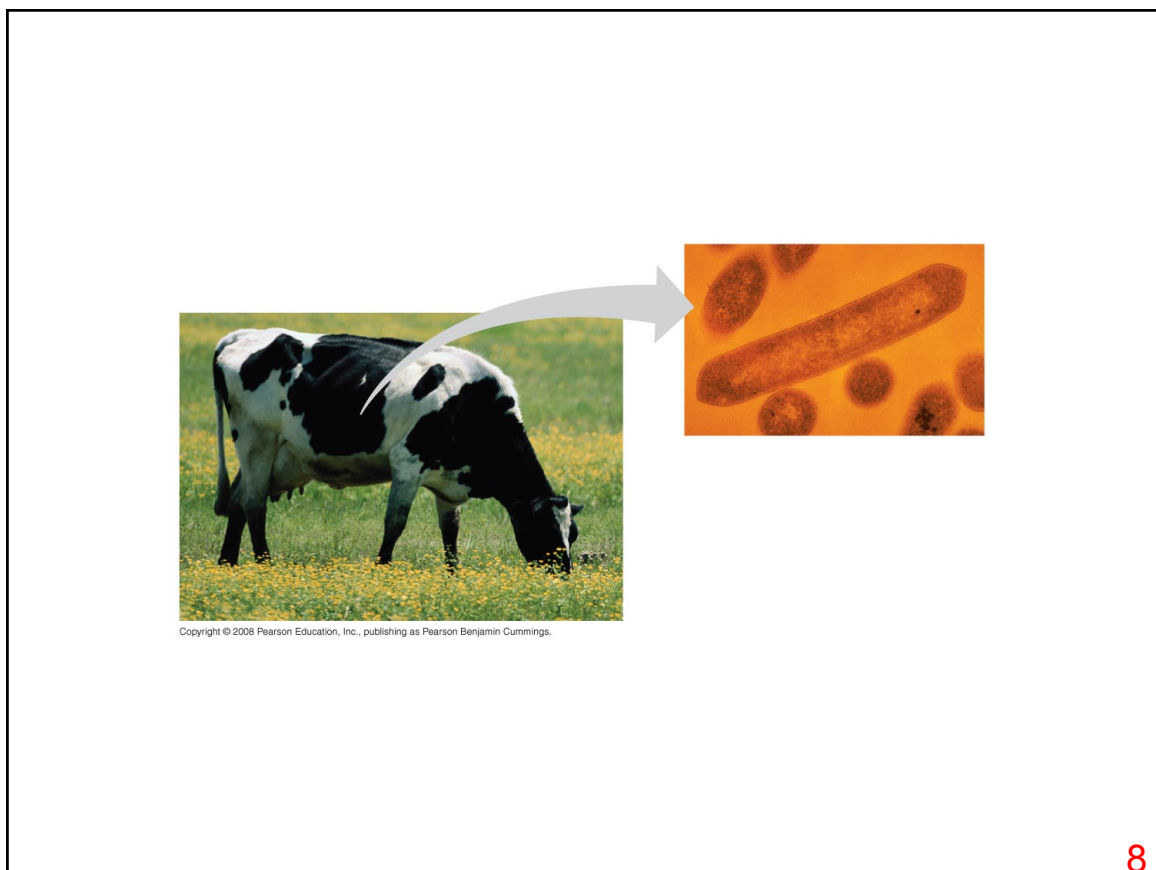


Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.

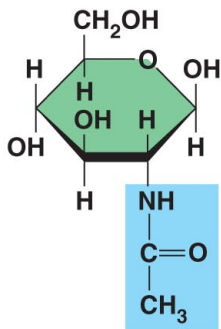
6



7



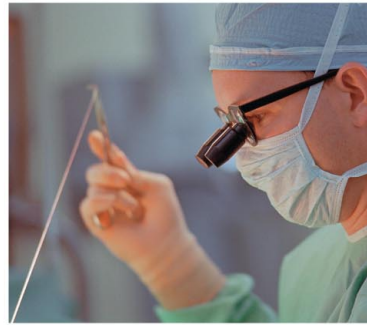
8



**(a) The structure of the chitin monomer.**

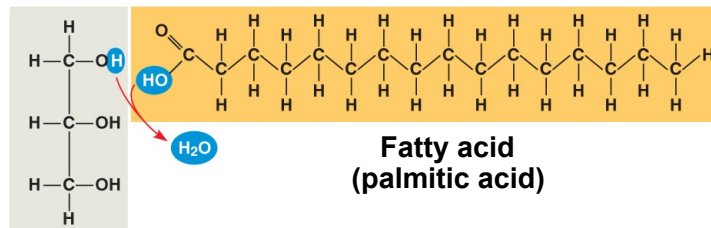


**(b) Chitin forms the exoskeleton of arthropods.**



**(c) Chitin is used to make a strong and flexible surgical thread.**

Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.

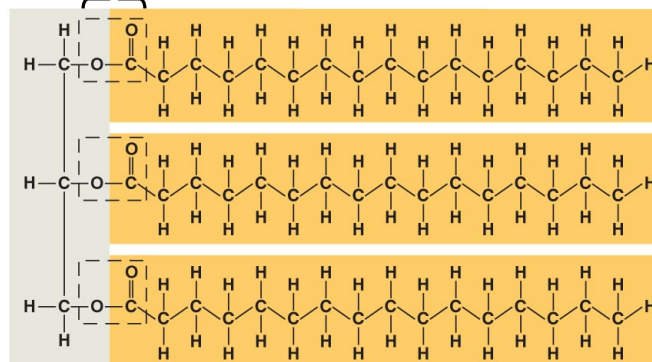


**Glycerol**

**Fatty acid  
(palmitic acid)**

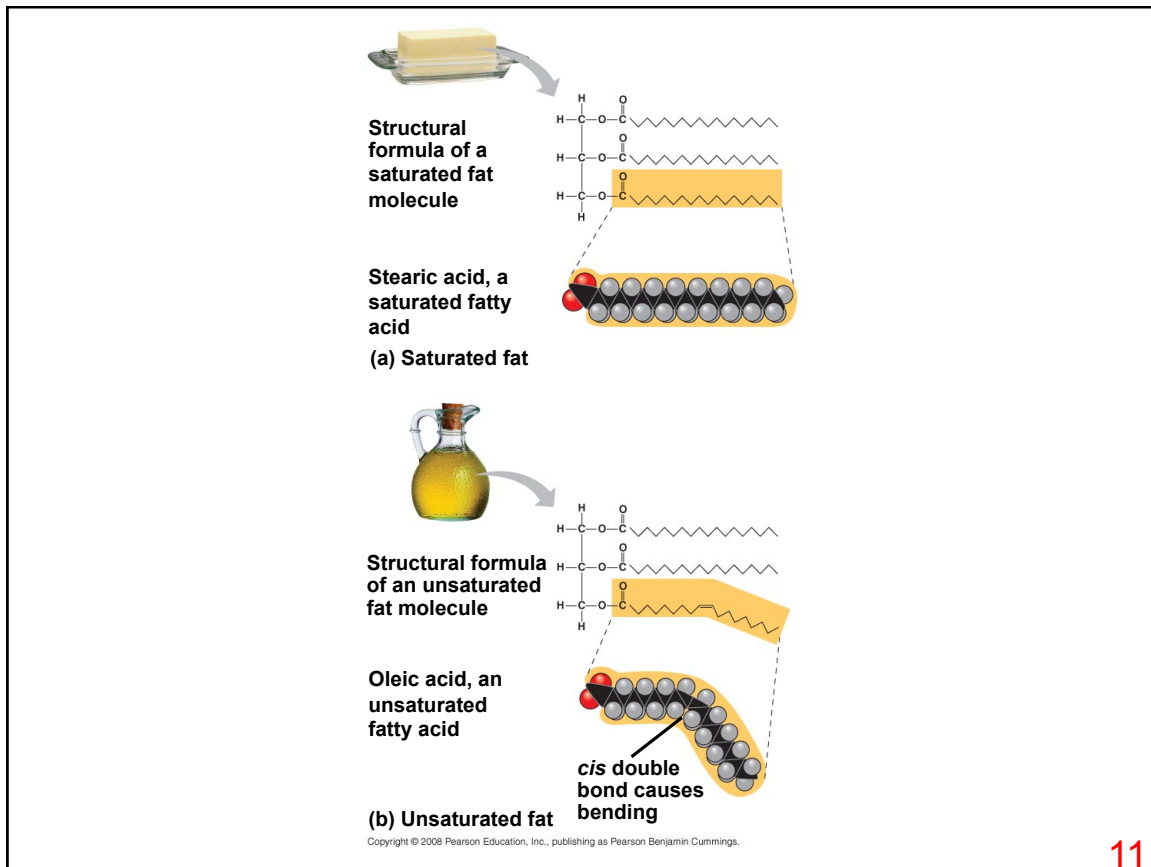
**(a) Dehydration reaction in the synthesis of a fat**

**Ester linkage**

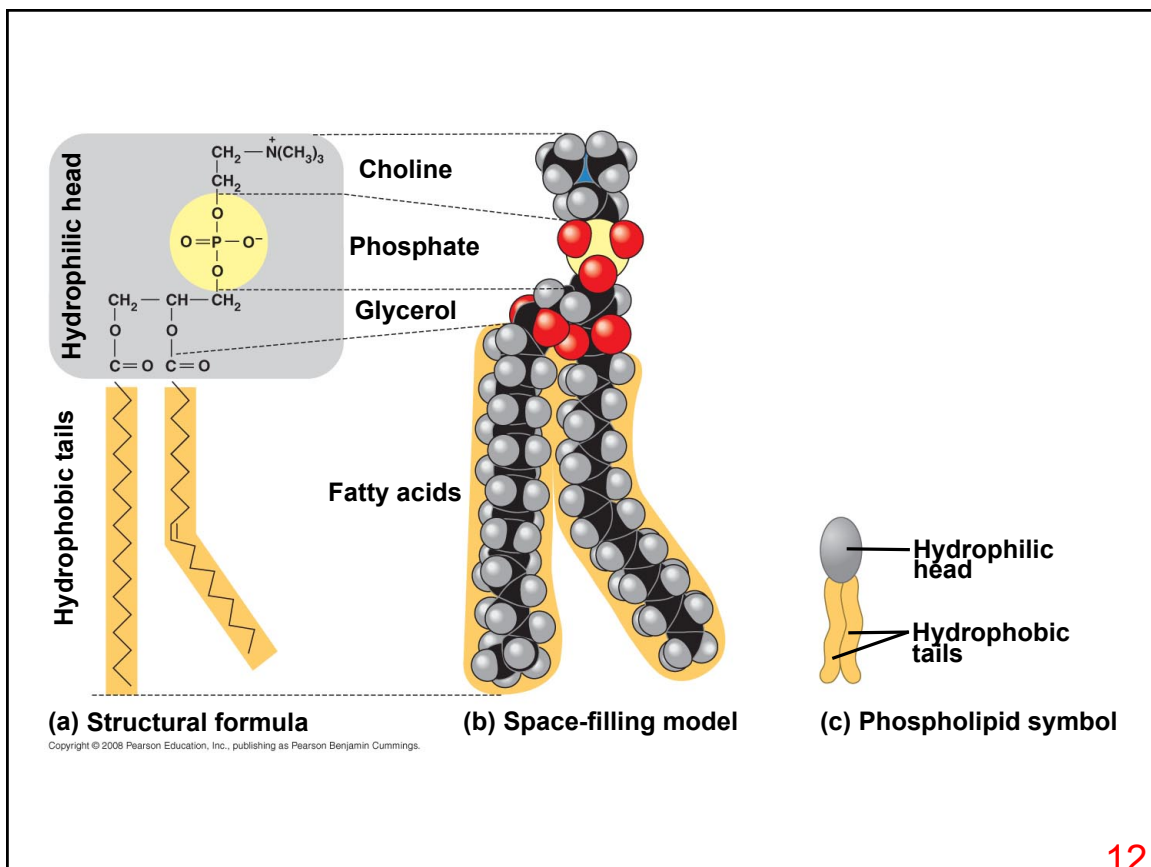


**(b) Fat molecule (triacylglycerol)**

Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.

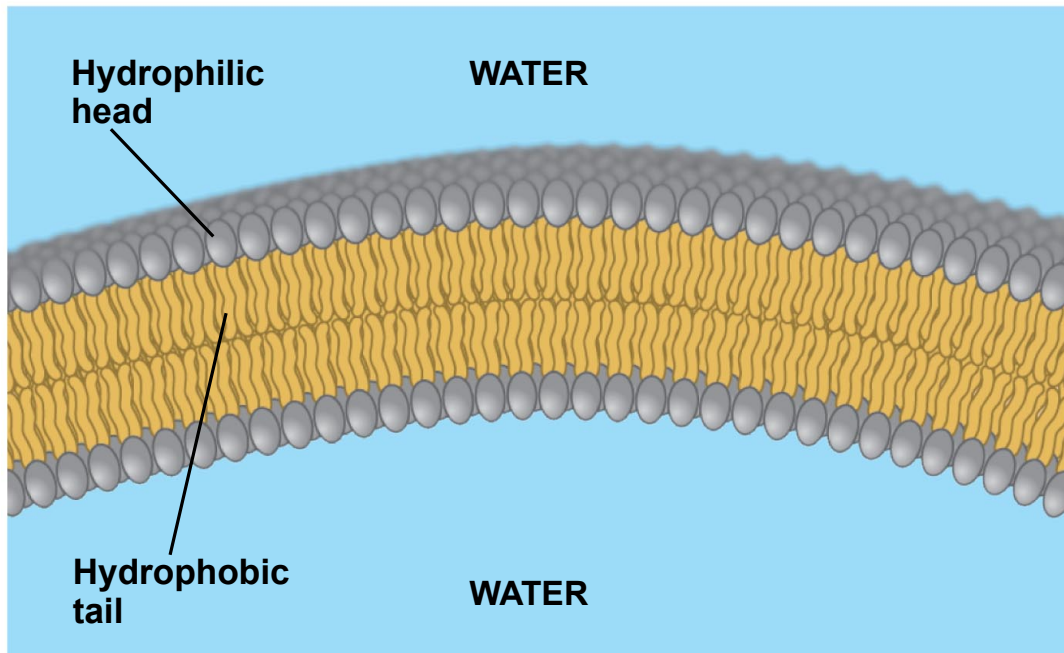


11



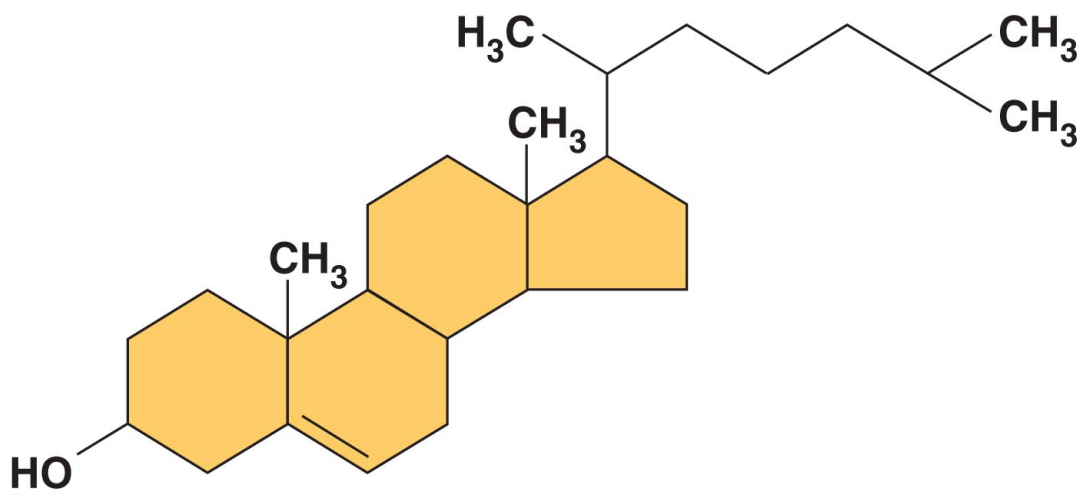
12





Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.

13



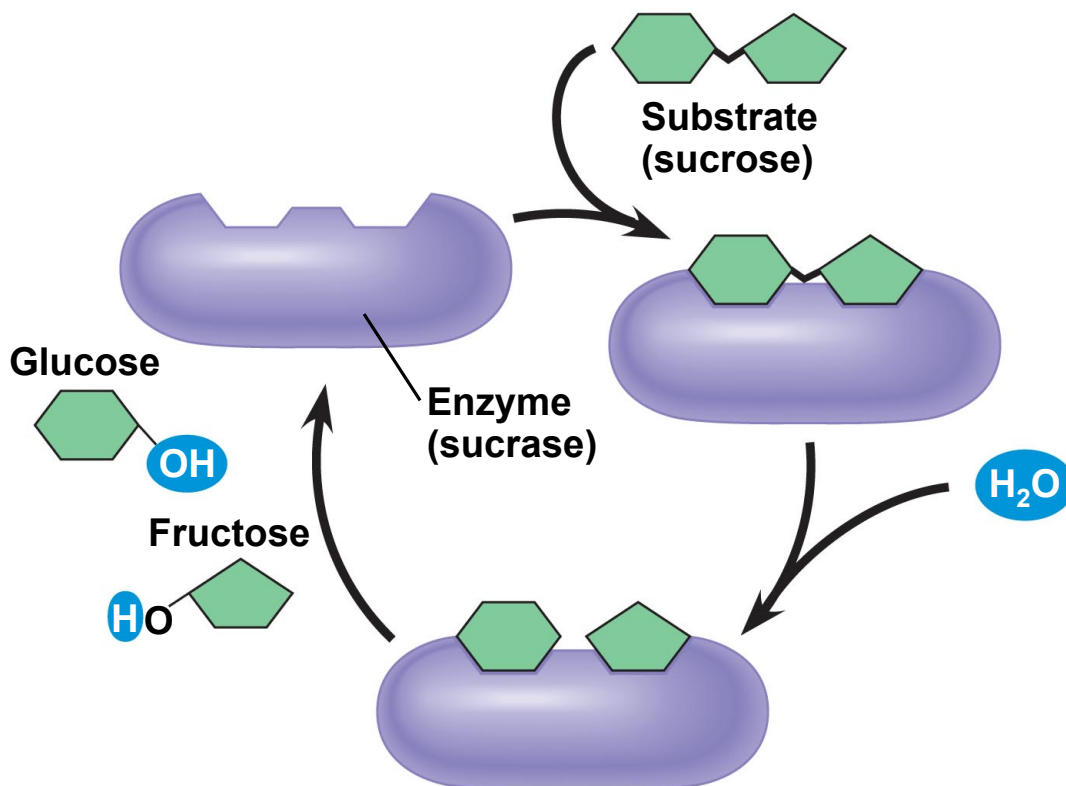
Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.

14

**Table 5.1 An Overview of Protein Functions**

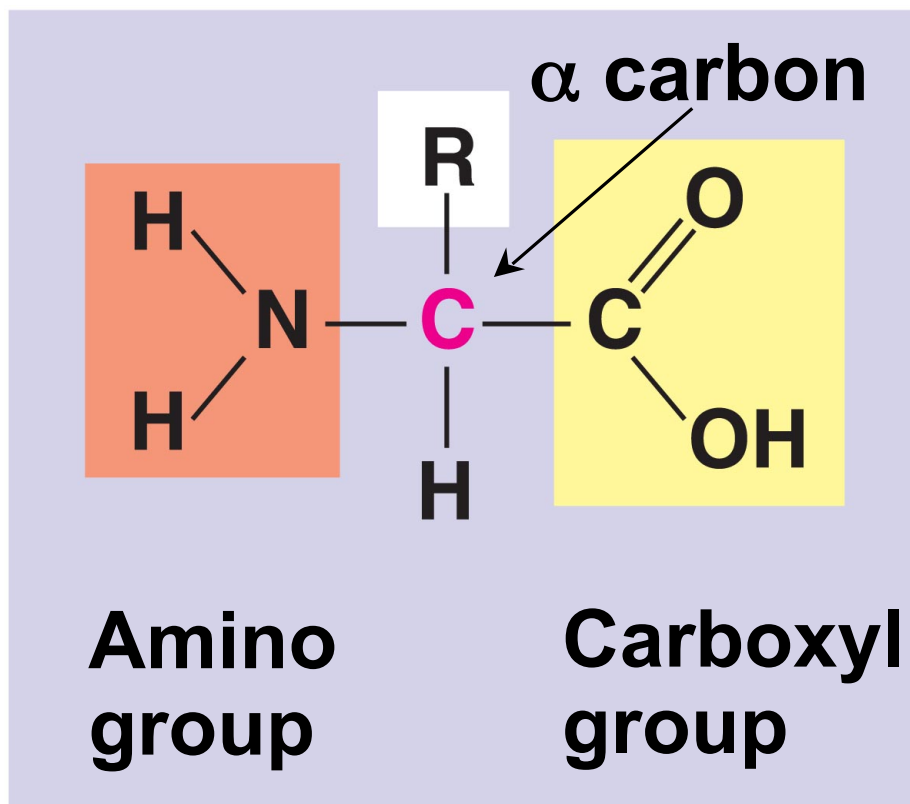
Type of Protein	Function	Examples
Enzymatic proteins	Selective acceleration of chemical reactions	Digestive enzymes
Structural proteins	Support	Silk fibers; collagen and elastin in animal connective tissues; keratin in hair, horns, feathers, and other skin appendages
Storage proteins	Storage of amino acids	Ovalbumin in egg white; casein, the protein of milk; storage proteins in plant seeds
Transport proteins	Transport of other substances	Hemoglobin, transport proteins
Hormonal proteins	Coordination of an organism's activities	Insulin, a hormone secreted by the pancreas
Receptor proteins	Response of cell to chemical stimuli	Receptors in nerve cell membranes
Contractile and motor proteins	Movement	Actin and myosin in muscles, proteins in cilia and flagella
Defensive proteins	Protection against disease	Antibodies combat bacteria and viruses.

Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.



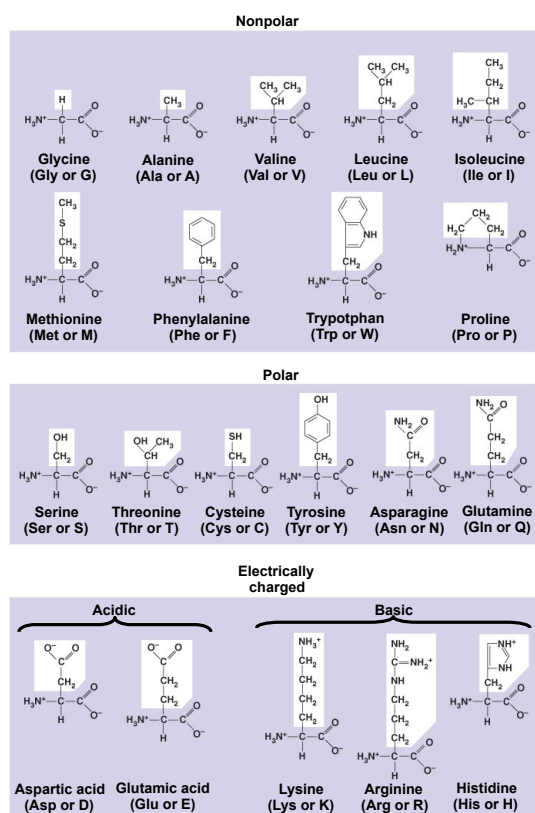
Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.





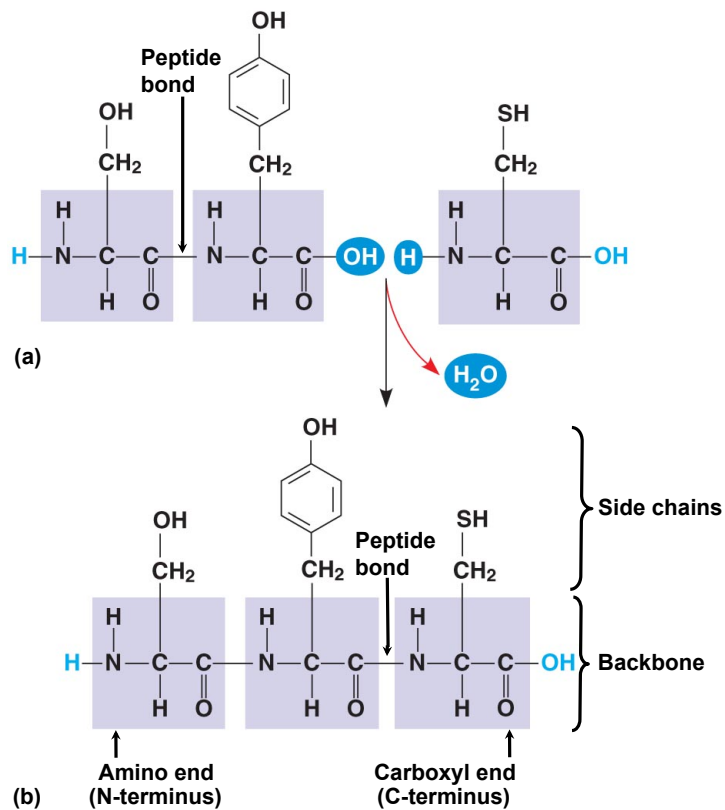
Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.

17



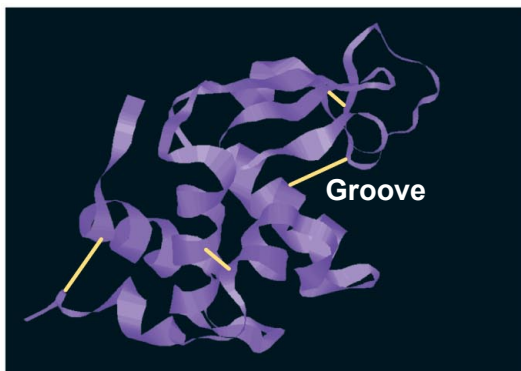
Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.

18



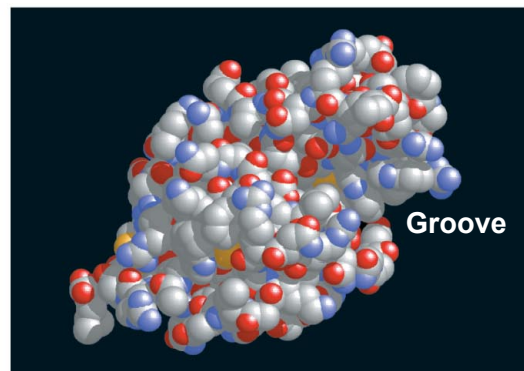
Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.

19



(a) A ribbon model of lysozyme

Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.

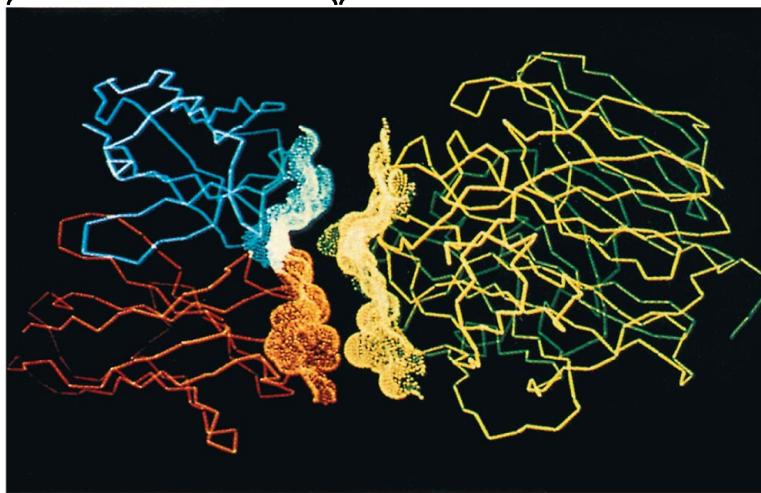


(b) A space-filling model of lysozyme

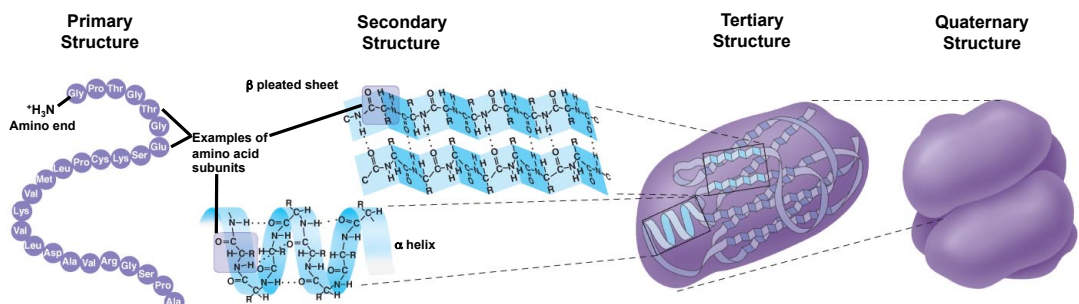
20

Antibody protein

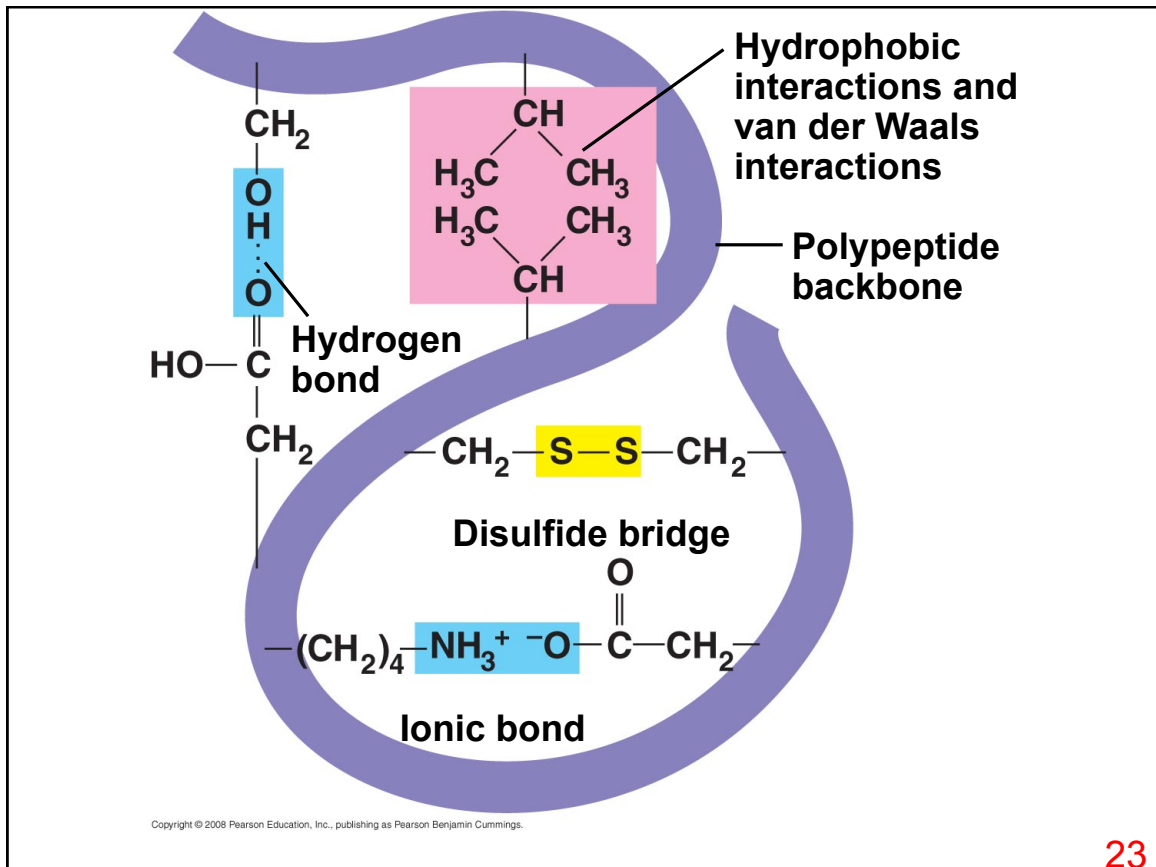
Protein from flu virus



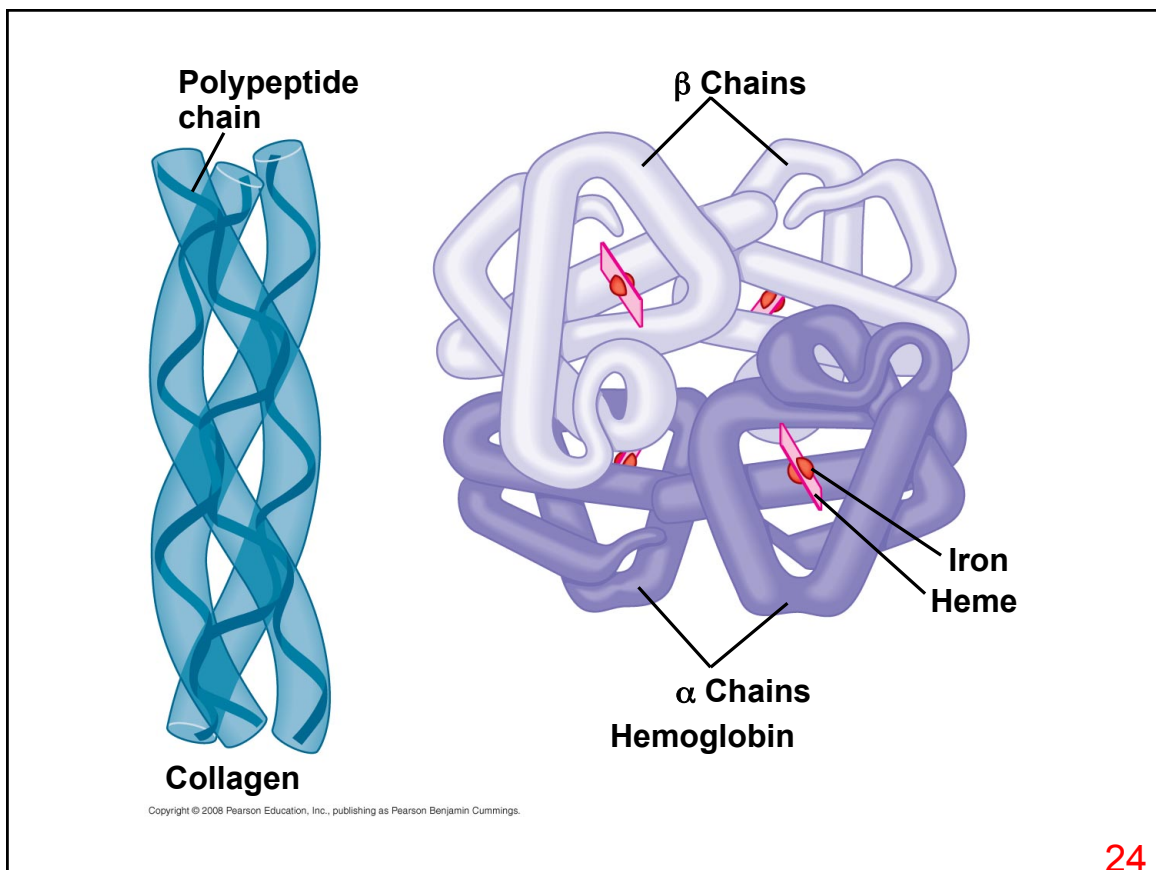
Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.



Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.



23



24

	Normal hemoglobin	Sickle-cell hemoglobin
<b>Primary structure</b>		
<b>Secondary and tertiary structures</b>		
<b>Quaternary structure</b>		
<b>Function</b>	<p>Molecules do not associate with one another; each carries oxygen.</p>	<p>Molecules interact with one another and crystallize into a fiber; capacity to carry oxygen is greatly reduced.</p>
<b>Red blood cell shape</b>	<p>Normal red blood cells are full of individual hemoglobin molecules, each carrying oxygen.</p>	<p>Fibers of abnormal hemoglobin deform red blood cell into sickle shape.</p>

Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.

25

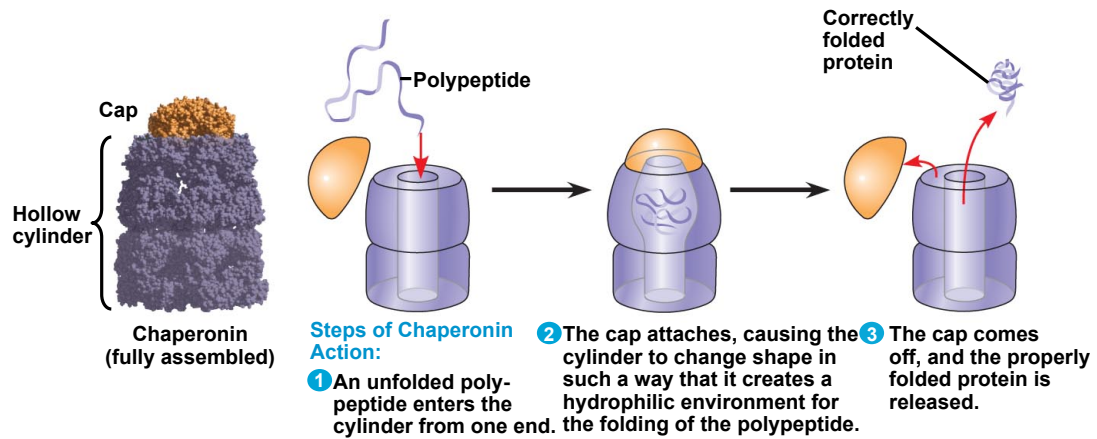
**Denaturation**

**Normal protein** → **Denatured protein**

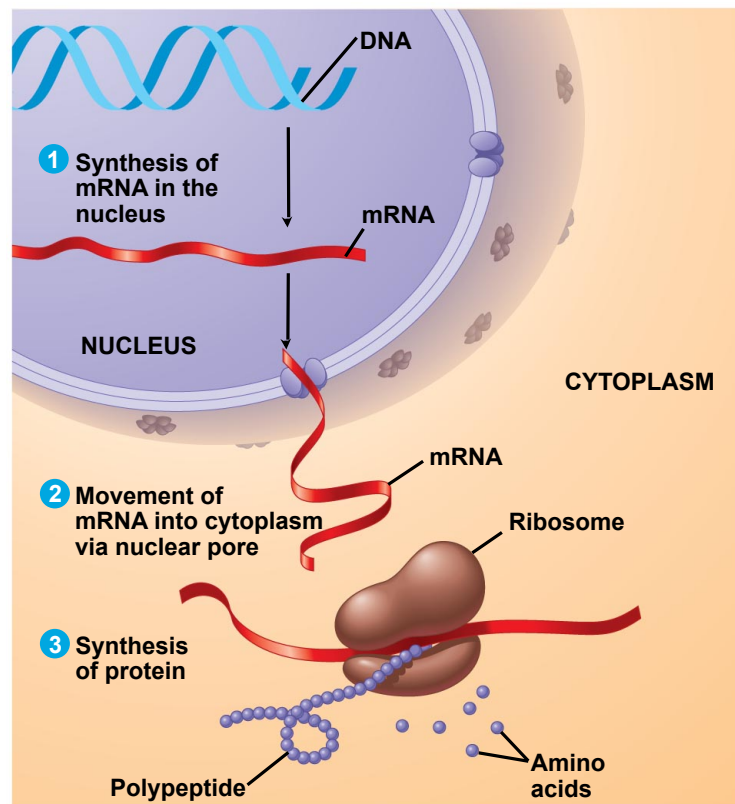
**Renaturation**

Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.

26

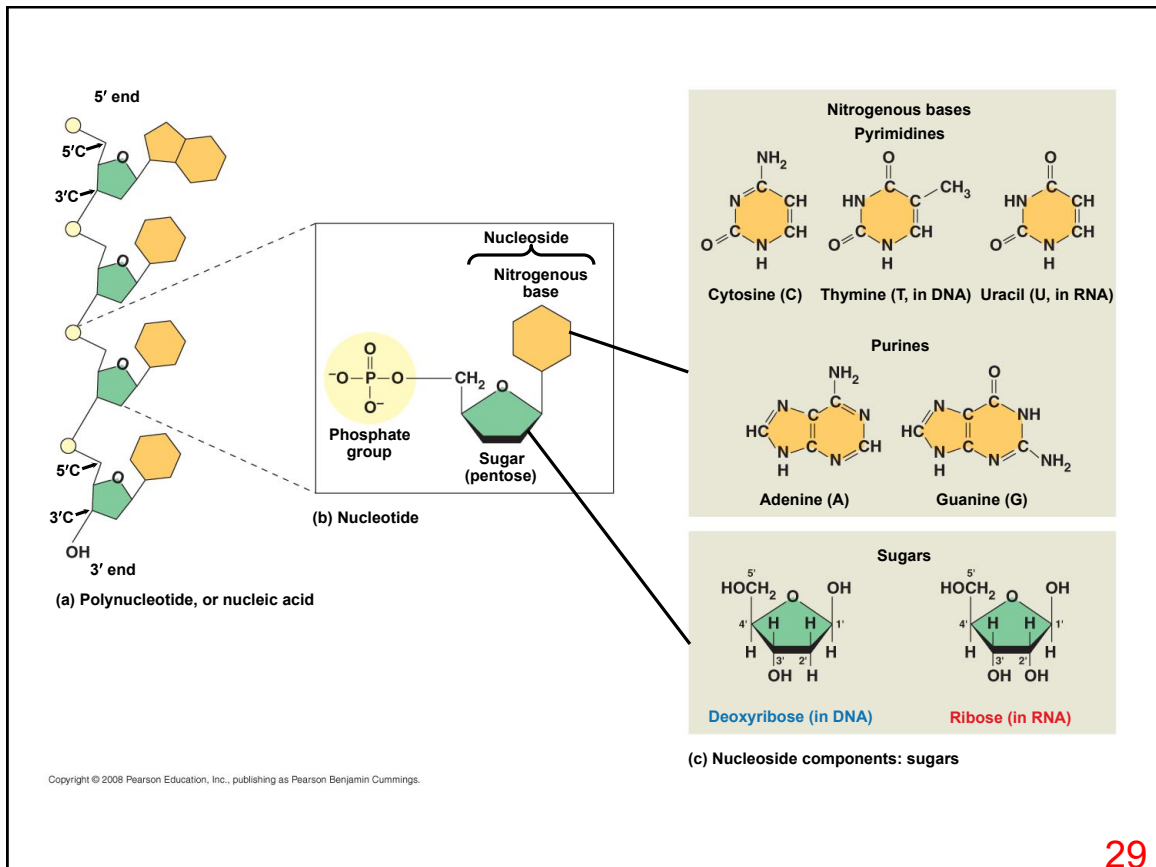


Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.

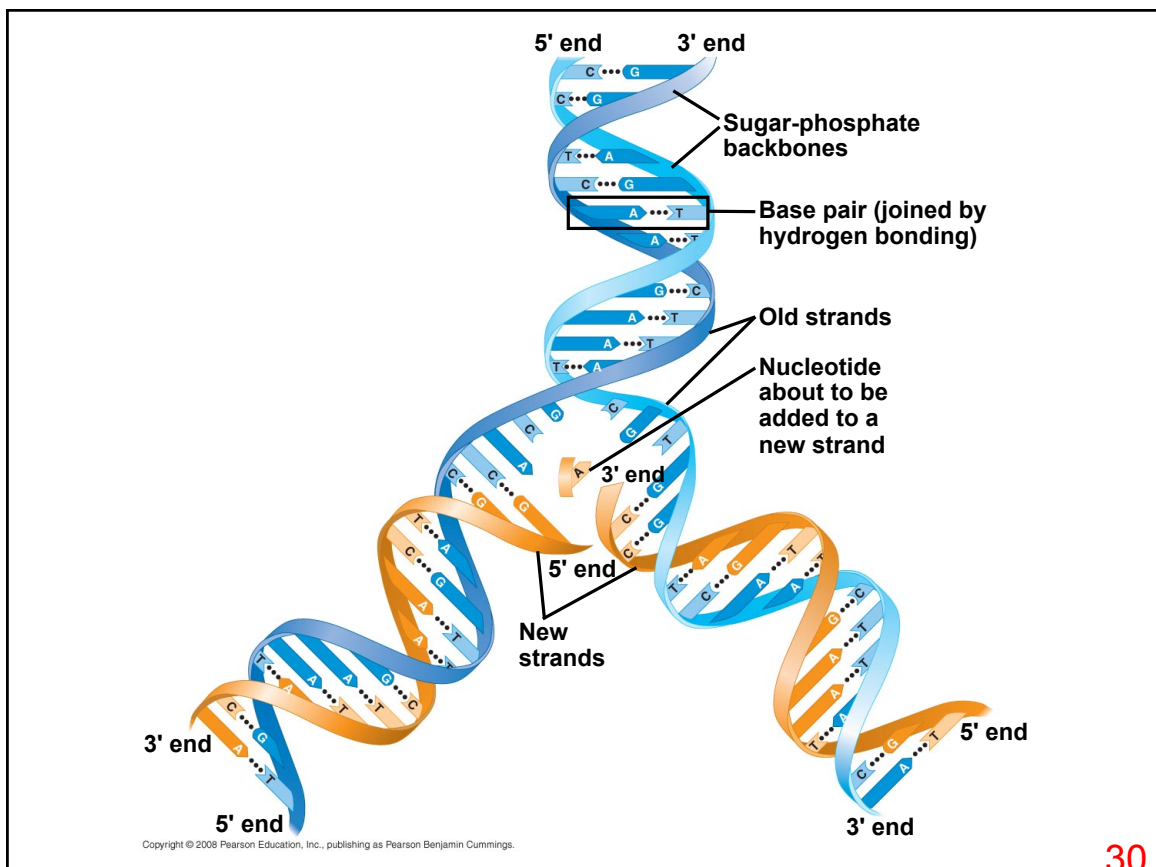


Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.

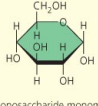



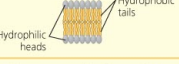

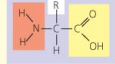
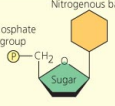






29



30

Large Biological Molecules	Components	Examples	Functions
<b>Concept 5.2</b> <b>Carbohydrates</b> serve as fuel and building material	 Monosaccharide monomer	Monosaccharides: glucose, fructose	Fuel; carbon sources that can be converted to other molecules or combined into polymers
		Disaccharides: lactose, sucrose  Polysaccharides: <ul style="list-style-type: none"> <li>Cellulose (plants)</li> <li>Starch (plants)</li> <li>Glycogen (animals)</li> <li>Chitin (animals and fungi)</li> </ul>	<ul style="list-style-type: none"> <li>Strengthens plant cell walls</li> <li>Stores glucose for energy</li> <li>Stores glucose for energy</li> <li>Strengthens exoskeletons and fungal cell walls</li> </ul>
<b>Concept 5.3</b> <b>Lipids</b> are a diverse group of hydrophobic molecules and are not macromolecules	 Glycerol 3 fatty acids	Triacylglycerols (fats or oils): glycerol + 3 fatty acids	Important energy source 
	 Head with $\oplus$ 2 fatty acids	Phospholipids: phosphate group + 2 fatty acids	Lipid bilayers of membranes 
	 Steroid backbone	Steroids: four fused rings with attached chemical groups	<ul style="list-style-type: none"> <li>Component of cell membranes (cholesterol)</li> <li>Signals that travel through the body (hormones)</li> </ul>
<b>Concept 5.4</b> <b>Proteins</b> have many structures, resulting in a wide range of functions	 Amino acid monomer (20 types)	<ul style="list-style-type: none"> <li>Enzymes</li> <li>Structural proteins</li> <li>Storage proteins</li> <li>Transport proteins</li> <li>Hormones</li> <li>Receptor proteins</li> <li>Motor proteins</li> <li>Defensive proteins</li> </ul>	<ul style="list-style-type: none"> <li>Catalyze chemical reactions</li> <li>Provide structural support</li> <li>Store amino acids</li> <li>Transport substances</li> <li>Coordinate organismal responses</li> <li>Receive signals from outside cell</li> <li>Function in cell movement</li> <li>Protect against disease</li> </ul>
<b>Concept 5.5</b> Nucleic acids store and transmit hereditary information	 Nitrogenous base Phosphate group Sugar Nucleotide monomer	DNA:  <ul style="list-style-type: none"> <li>Sugar = deoxyribose</li> <li>Nitrogenous bases = C, G, A, T</li> <li>Usually double-stranded</li> </ul>	Stores all hereditary information
		RNA:  <ul style="list-style-type: none"> <li>Sugar = ribose</li> <li>Nitrogenous bases = C, G, A, U</li> <li>Usually single-stranded</li> </ul>	Carries protein-coding instructions from DNA to protein-synthesizing machinery

Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.